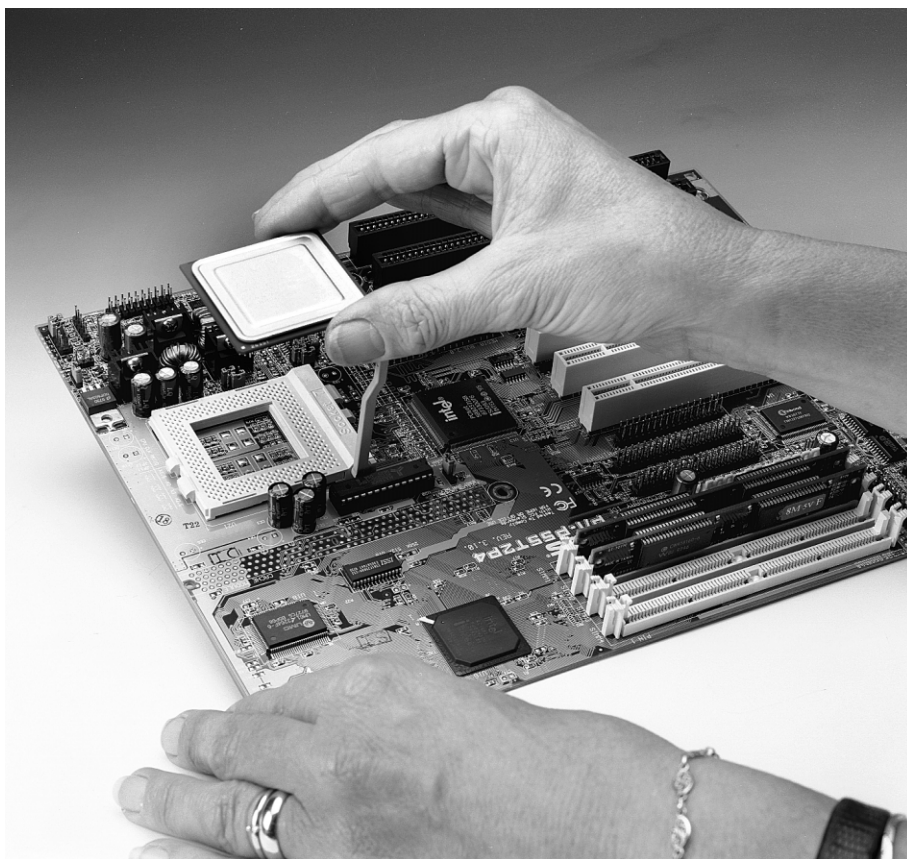


Older-model Socket-7 motherboards can be modified to provide problem-free support for modern processor ICs, using only simple and inexpensive modifications. Sometimes it's only necessary to adjust certain undocumented jumper settings.

by R. Schulze

PC Upgrade

modernizing old motherboards



Nowadays, the development cycle for computer technology has been reduced to such a short interval that it's necessary to acquire a completely new computer system every year, just to be able to run the latest software or at least to avoid joining the ranks of the has-beens. This article describes how you can save a lot of money by making a few simple modifications to the old hardware. In the best case, just a few centimetres of wire and some 'intelligent' jumper settings suffice to allow a modern, 500 MHz AMD K6-3 processor to run on the old mother-

board.

Of course, we don't want to try for the utmost right off the bat, so let's start with an AMD K6-2 processor running at 350 MHz, which has become quite inexpensive these days. We will use the ASUS P/I-P55T2P4 motherboard as an example. If you have an eye for quality and you have bought your PC in the last three years, you most likely have an ASUS T2P4 in your PC.

Penny wise

The wheat gets separated from the chaff the first time the PC needs to be

upgraded, and the consequences of not making the original purchase from a well-stocked dealer can be dramatic. The owner of high-quality hardware can take pity on the bargain-hunter who buys his PC from a mega-discount shop. Unfortunately, the hardware on offer in such shops all too often has a usable lifetime of only 12 months, with no sort of upgrade potential.

Before making a hardware upgrade, you should first acquire the latest version of the BIOS. Otherwise, you risk unusual effects the first time you start up the computer with its new hardware, even if the hardware modifications have been correctly carried out. Older BIOS versions often do not support new processor functions, or do not support them correctly. So, before you switch on the soldering iron, first download the new BIOS from the Internet. You can use the Flash program (see inset) to copy the new version to the Flash ROM in place of the old BIOS. After this, there's nothing to hinder the use of a new 'electronic brain'.

With the T2P4 motherboard, there is a certain threshold with regard to the extent of the modifications, and this has to do with the revision number. Revision 2.xx boards require an additional voltage regulator to be built, as shown in Figure 1. This is not necessary with revision 3.xx and above, since in the latter case the desired results can be obtained by simply repositioning jumpers. Two versions of the voltage regulator have to be built. The first version supplies the power-hungry processor core with 2.2 to 3.2 V, according to the processor type, with a load capacity of up to around 10 A. The second version supplies the I/O portion of the processor with 3.3 to

3.5 V, with a load capacity of around 1A. The booster transistor (BD250) is not needed in the second version, due to the lower current demand.

Lucky man

If your motherboard happens to be a T2P4 type with a revision number of 3.xx or higher, the additional voltage regulator is not necessary, since these motherboards already have provision for a dual supply for the CPU IC.

In this case, all that is needed is a wire bridge to the CPU socket and the correct jumper settings. Alternatively, the wire bridge can be soldered to the back side of the board. This simplifies removing and inserting the CPU IC, since the wire cannot slip out of the socket along with the IC pin. The placement of the wire bridge at Socket 7 is shown in Figure 2. If you want to permanently fit the wire bridge by soldering it between two solder points, instead of using the simple solution, you will naturally have to dismount the motherboard, but this approach provides better reliability with regard to CPU exchanges. Figure 3 shows how the wire bridge should be soldered to the underside of the motherboard. Regardless of how the bridge is fitted, its role is to act as the 'missing' jumper for the BF2 pin, which carries the third (most significant) bit of the parameter that determines the relationship between the internal CPU clock and the bus clock (see inset).

Now we only have to correctly select the supply voltage for the processor core. The core voltage (Vcore) is usu-

Flash utility

You should perform a BIOS update before upgrading the processor to avoid having the CPU incorrectly designated as a 486 type in the BIOS, or a complete failure of the system to start up. You can find more information about using the Flash utility in the motherboard manual. To start with, place the programming-protection jumper, found on many motherboards, in the write-enable position. Then boot with a DOS diskette that does not contain any sort of memory manager (HIMEM or EMM386). Now you can run the Flash program. First back up the old content of the flash ROM to a diskette. Only after doing this should you update the flash ROM. Now restart the system with RESET, and immediately bring up the BIOS Setup utility using DEL. Select the function 'Load Setup Defaults' to restore the default parameters in the Setup CMOS memory. Following this, you can confidently install a new CPU.

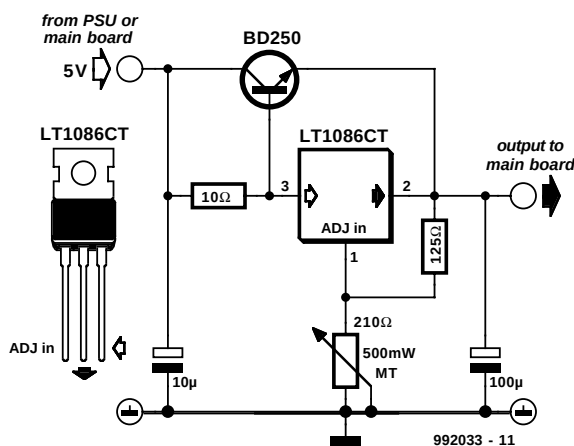


Figure 1.

Circuit diagram of the Realer LT 1086 for the core and I/O supply voltages of the CPU IC.

ally indicated on the CPU IC. With our example T2P4 motherboard, we need a 2.2 V core supply voltage at 350 MHz, so we connect pin 1 to pin 2 and pin 3 to pin 4 in jumper block

JP20. This connects the 85 kΩ and 130 kΩ resistors of a motherboard resistor array in parallel (see Figure 4), which causes the output of the core voltage regulator to be

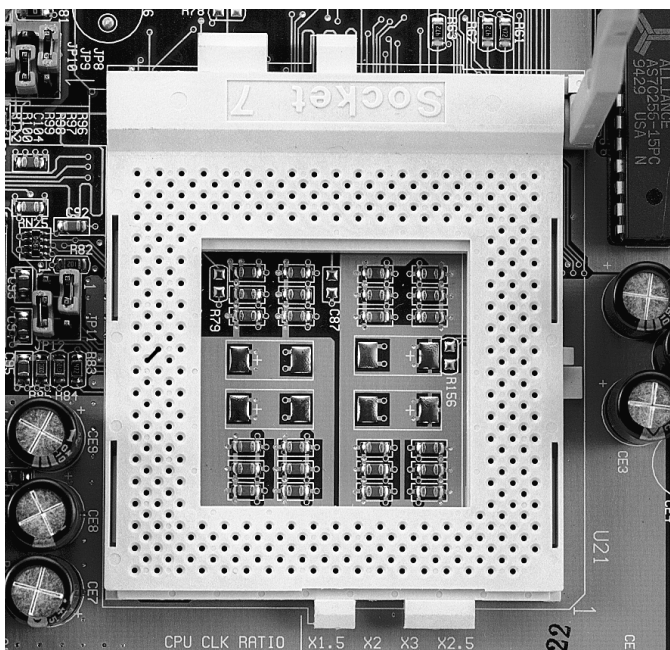
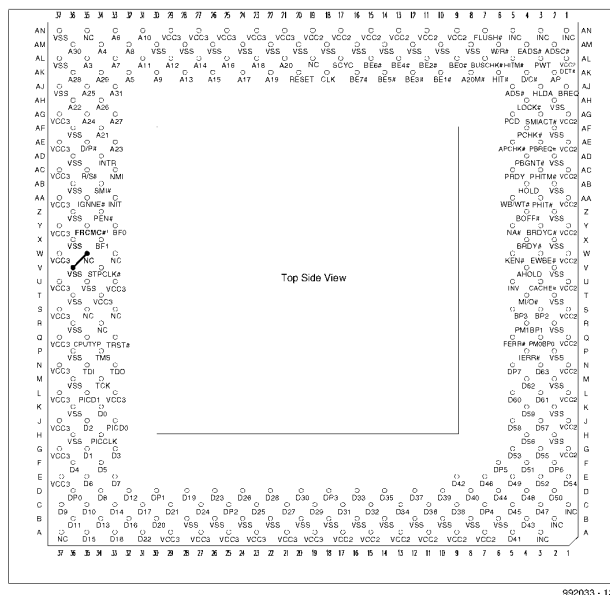


Figure 2. Top view of Socket 7, showing the location of the 'simple' wire bridge.





Bus clock and internal CPU clock

The speed of the internal CPU clock always has a direct relationship to the speed of the bus clock. The ASUS T2P4 motherboard, from revision 3.xx onwards, supports bus clock frequencies from 50 to 83 MHz. Two pins (BF0 and BF1) allow factors between 1.5 and 3 to be selected. However, with a 350 MHz CPU we need a factor of 5.5 with a 66 MHz bus clock. If you do the arithmetic, you will find that this results in an internal CPU clock rate of 363 MHz. This is not a problem; a 350 MHz CPU will also run at 366 MHz. Almost all standard commercial CPU ICs can handle a few extra megahertz. You can also experiment with a 75 MHz bus clock. A serious disadvantage of this, however, is that it is not synchronized to the 33 MHz PCI clock. This means that a 75 MHz bus clock is only suitable for applications that practically do not use the PCI bus or communicate with peripheral devices. This basically amounts to scientific calculations that are processed in RAM. For games, graphical applications and the like, output via the PCI graphics card is essential. With a 66 MHz bus clock, this will execute synchronously and thus more efficiently.

approximately 2.2 V. Other core voltages for various types of CPU ICs are listed in Table 1.

Before you install the new CPU, you should check the new core voltage using a multimeter. The contacts that carry the supply voltage can easily be located at the socket. They are primarily located in the outermost row of contacts. In any case, there is a separation line that runs through the middle of the socket array, parallel to the quick-release lever. The pin contacts on the lever side carry the core voltage (VCC2), while the contacts on the opposite side carry the I/O voltage (VCC3). The best way to measure the voltage is to insert a short length of wire into contact U1, for example, and close the lever (U1 is located in the contact row directly next to and paral-

CPU/bus clock ratio

CPU Pin:	BF1	BF0
T2P4 Jumper:	JP11	JP12
x1.5 / 3.5 (5.5)	1-2	1-2
x2.0 / 4.0 (6.0)	2-3	1-2
x2.5 / 4.5 (6.5)	2-3	2-3
x3.0 / 5.0 (7.0)	1-2	2-3

Ratio without BF2; with BF2

The bus clock ratio is generated in the CPU, and is only selected externally by means of pins BF0, BF1 and BF2. If the 'BF2' jumper is set, the bus clock ratio is doubled with K6 and K6-2 CPUs. By contrast, a fourfold increase is achieved with newer CPUs having the CTX core, for example, all new K6-2 and K6-3 processors.

lel to the lever, in the middle group of contacts, around halfway along the lever). A voltage in the range of 2.15 to 2.25 V must be measured between this point and earth immediately after the PC is switched on. This variation from the nominal voltage is not critical,

Table 1

Core voltage	Jumper pins JP20
2.0V	1-2, 3-4, 5-6, 7-8
2.1V	1-2, 3-4, 5-6
2.2V	1-2, 3-4
2.3V	1-2, 5-6
2.4V	3-4, 5-6
2.5V	1-2

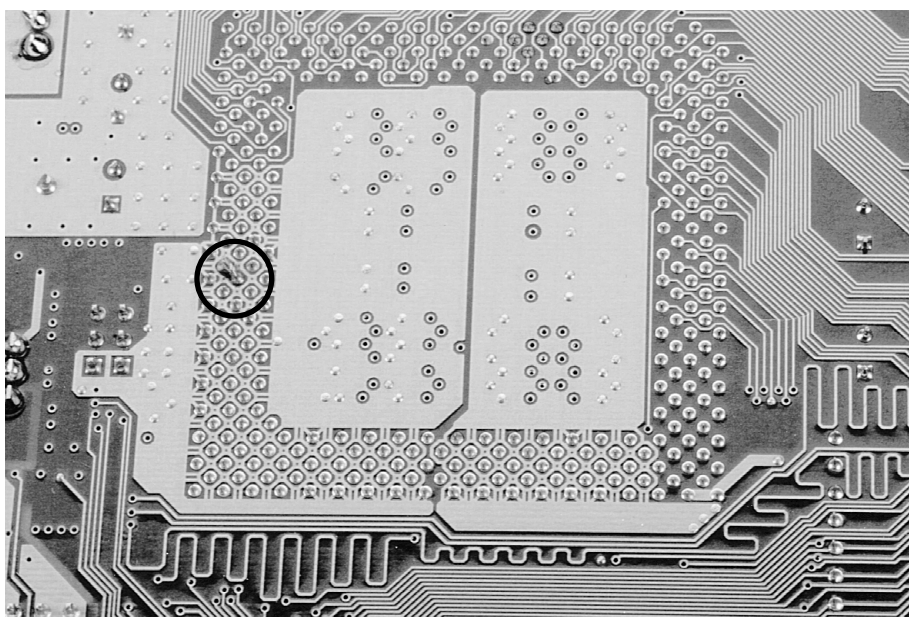


Figure 3. Bottom view of the Socket 7 position, showing the location of the soldered wire bridge.

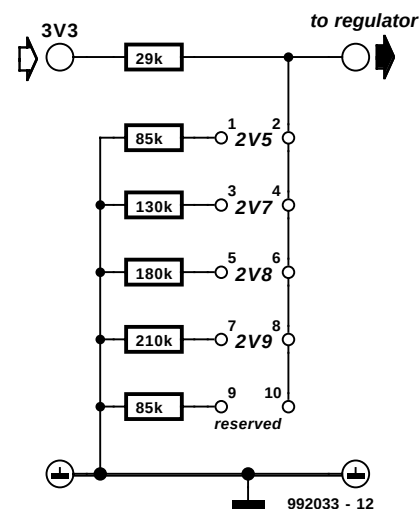


Figure 4. The CPU core voltage is selected via jumper block JP20 on the ASUS motherboard.

since CPU ICs will operate without any problems with a voltage tolerance of around 5%. It's true that a higher voltage produces more heat, but processor operation is more stable when the voltage is too high than when it is too low. You should also check the I/O supply voltage of the CPU. To do so, measure the voltage at pin U37 (located in the middle set of contacts in the row furthest away from the lever). The indicated voltage should be 3.3 to 3.5 V. Now that the issue of the CPU supply voltage has been successfully dealt with, we can turn our attention to CPU cooling. This is important: you must always make sure that the CPU is adequately cooled! In case of doubt, too much cooling is better than too little, since processors like to fail (temporarily or permanently) if the operating temperature is excessive (more than 70°C). Small violations of the temperature limit show up at first in the form of crashes, while serious overheating will send the processor to the happy hunting ground. The recommended Socket-7 coolers have heat sink fins that are at least 2 cm long, with a 50-mm fan mounted on top. The best arrangement has a 60-mm fan fitted on edge alongside the socket. Only with this arrangement will the CPU cooler have sufficient passive cooling capacity to avoid an immediate processor failure in case of a fan failure.

If the voltages are all OK and you have verified that the jumpers are correctly positioned, you can install the CPU IC. However, be careful if you have chosen to use a wire bridge fitted into the socket. Insert the IC carefully to avoid damaging the wire bridge.

Now you're ready to switch on the computer. As a rule, you will see that your applications have been distinctly speeded up. However, no significant changes will be noticeable in the boot-up process of the operating system, since the loading times are essentially determined by the hard disk.

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Useful Internet addresses

<i>Abit</i>	www.abit.com.tw
<i>AMI</i>	www.ami.com
<i>AOpen</i>	www.aopen.nl
<i>Asus</i>	www.asus.com.tw
<i>A-trend</i>	www.atrend.com.tw
<i>Award</i>	www.award.com
<i>BMG Biostar</i>	www.biostar.com.tw
<i>ChainTech</i>	www.chaintech.com.tw
<i>Elitegroup</i>	www.ecs.com.tw
<i>EpoX</i>	www.elito-epox.com
<i>FIC</i>	www.fic.com.tw
<i>Gigabyte</i>	www.giga-byte.com
<i>iWill</i>	www.iwill.com
<i>Micronics</i>	www.diamondmm.de/ger/products/sysbrds.htm
<i>MSI</i>	www.msi.com.tw
<i>QDI</i>	www.qdi.nl
<i>Soyo</i>	www.soyo.com.tw
<i>Supermicro</i>	www.supermicro.com
<i>Tekram</i>	www.tekram.com.tw
<i>Tyan0</i>	www.tyan.com

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